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SAFETY AUDIT OF TRAFFIC CONTROLAT ROAD WORK SITES
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Aims of the Paper

In this paper I will

- Present the safety audit method
- Give results of the audits to date and
- Discuss some issues

The aim of this work is to improve the safety of road workers and of road users at roadwork sites. In doing so, the aim is to reduce the possibility of injury and death, as well as litigation and roadwork site closure. It is certainly not my intention to criticise or point the finger. We have identified and quantified a problem. The audits do not enable us to provide solutions.

Why did we do this in first place?

The main incentive for this work is the numbers and severity of crashes at road works. The Land Transport Safety Authority (LTSA) has analysed the crash data for 1996. Their report states, amongst other things, *"The accidents at roadwork sites are.. more frequently fatal crashes and less frequently non-injuries than the average traffic accidents in New Zealand. In other words the severity is higher than the national average."* The fatality rate is three times the national rate. The number of crashes occurring at roadworks sites in 1996 was 213, with a cost to the nation of $19 million.

The LTSA Crash data identifies the main crash types. These are:

- Lost Control on bends 31%
- Lost Control on straights 24%
- Rear end Crashes 20%

Under the Health and Safety in Employment (HSE) Act, Contractors are responsible for ensuring that roadwork sites are as safe as practical both for their employees and for the public. OSH is responsible for administering the HSE Act. Road Controlling Authorities (RCA's) have a responsibility to maintain a safe roading network. This includes any and all on road activities such as roadwork sites.

What else is happening?

In terms of standards and guidelines, there are three documents in general use. These are:

- TNZ "Working on the Road" Handbook
- Transit New Zealand's Specification TNZ G1 May 1996
- Transit's Draft HCH (High Capacity Highway) Code of Practice

Transit has convened a working group to consolidate the best practices into one integrated document. Transit has released a "Draft for comment" of the new manual for Temporary Traffic Control to the industry.

Each year the LTSA conducts surveys of traffic standards and guidelines. In 1998 they surveyed amongst other things, traffic control at roadwork sites. The results of this survey were published in their report RSS8 "Traffic Control at Roadwork Sites". The report states:

- *"The traffic control issues identified by road controlling authority engineers often related to the inappropriate use of signs"*; and
- *"The field surveys demonstrated significant gaps in the on-street performance of contractors"*.

Consultation

In the course of our work we have consulted with the following:

- Road Controlling Authorities: We sent the results of our pilot audits to the relevant RCAs for their comment.
- Transit: We have maintained close contact with Transit's working party and shown them the results of our audits.
- LTSA: Transfund assisted the LTSA with their surveys and the LTSA provided a member for our teams.
- Contractors Federation: Discussion have been held with Executive.
- Public Industry seminars were held in 7 centres during May. Over 500 people attended.

The Interim Procedures

In this section, I will summarise the main features of the procedures. For further details the reader should consult Transfund's document RA98/689S "Interim Procedures for the Safety Audit of Traffic Control at Roadwork Sites". The procedures are based on experience gained in three pilot audits. We have written the procedures for an independent audit team that is commissioned to audit a number of sites over a period of some days. However, they can be adapted to audit single sites.

We anticipate that the procedures could be used by:

- Transfund
- Road Controlling Authorities
- Service Authorities
- Consultants
- Contractors

The procedures contain the administrative details about how to set up, how to undertake, and how to report on an audit. But I will concentrate on the inspection method.

Inspection Method

We drove the sites as a road user, using a driver who was not familiar with the roads. Our teams included two Consultants who conduct Transit NZ certified training courses on temporary traffic control and are conversant with the technical requirements. We were helped by the LTSA whose representative also operated a video camera. The video was vital for confirming the observations made on site and also provided a permanent record. We used an unmarked rental Toyota Previa.

We drove through the site three times. On the first drive through we recorded the location, the RCA, the Contractor and what was happening at the site i.e. what sort of work was being undertaken. We videod the site. At the end of the first drive through we completed a basic sketch of the site and completed a checksheet (these are detailed in appendix 1 of the Interim Procedures).

Then we drove back through the site, making the same observations in the opposite direction. Now we completed the layout diagram for the main route and completed the checksheet. The third drive through was for checking the intersections (side roads) and completing the video record of them. We took photographs from inside the vehicle, stopping where it was safe to do so. At the end of the third drive through we completed the layout diagrams, and the documentation. It is especially important that the team agreed on the "Site Hazard Rating" before they leave the site. A description of the rating system follows.

Site Hazard Rating

We needed a method of determining how relatively safe the sites actually were. What action should be taken? Thus we developed a method we have called a "Site Hazard Rating". It evolved during the pilot audits. It is a pragmatic approach based on the experience and judgement of the pilot audit team members. It is not based on any scientific theory or statistical analysis.

The Site Hazard Rating (or SHR) estimation formula check sheet is in appendix 2 of the Interim Procedures. A worked example is included in the proforma report in Appendix 6. The SHR has three components that are multiplied together:

- Site Condition Factor
- Site Complexity Factor
- Traffic Effects Factor

The Site Condition Factor is like a "Compliance with good practice". Each element of non-compliance is given a number that reflects its relative importance. For example: A worker not wearing a high visibility jacket scores 5, while a sign on the right hand side but not on the left hand side scores 1. The scores for each element of non-compliance are summed to give the Site Condition Factor.

The Site Complexity Factor reflects the risk and exposure, in that high speed / high traffic volume sites are more likely to suffer crashes than low speed / low volume sites. Other factors taken into account are the number of intersections, and the presence of cyclists and pedestrians.

The Traffic Effects Factor takes account of what the traffic is being asked to do. The minimum is "Work not in Carriageway" which scores 1. Here the traffic can continue through the site unimpeded. The maximum "Traffic Passing site in Single Lane" presents the possibility of head on collisions and it scores 10.

These three factors are multiplied together to create the SHR. We are trying to reflect the numbers of crashes likely to occur, not the crash rate. However, the numbers are abstract and have no inherent meaning; other than to "slot" the hazard presented by each site, into an appropriate category. The members of the pilot audit teams have agreed on the following categorisation of the SHR:

- 0 to 300 – Satisfactory
- 301 to 1500 – Marginal
- 1501 to 2500 – Serious
- +2501 – Critical

These categories are described more fully in appendix 3 of the Interim Procedures. We recognise that these categories may be controversial and will need to be tested by other auditors.

Promulgation of the Interim Procedures

A copy of the Interim Procedures has been sent to every RCA, the LTSA and NZ Police. In addition, at the series of seminars mentioned above, we gave a copy of the interim procedures to each member of the audience.

In promulgating the Interim Procedures we urge the industry to use them, and to provide us with feedback on them. Addresses for feedback are on page 3 of the Interim Procedures.

Results of the Pilot Safety Audits

To date we have conducted four pilot audits:

- Wellington/ Wairarapa (1997)
- Northern Canterbury (1998)
- Auckland North (1998)
- Waikato (1999)

In addition, some RCAs and Service Authorities have started to use the Interim Procedures.

(Transfund NZ) 1997 & 1998 Audit Results

We audited 74 sites. This table shows the split by category type. Readers should note that after the 1998 audits the rating system was modified, so that these numbers are not strictly comparable with the ratings in the Interim Procedures. If we did use the rating in the Interim Procedures, the number of "Satisfactory Sites" would probably be about 10, and the number of "Critical" sites would reduce a little. Nevertheless we considered that over one third of sites we saw were "critical".

Category	Number of Sites
Satisfactory	0
Marginal	30
Serious	13
Critical	31

(Transfund NZ) 1999 Waikato Audit

The LTSA crash data indicated a significant incidence of crashes in the dark (44%). Hence we conducted this audit specifically to (a) test the Interim Procedures and (b) to compare sites during the day and night. Although we audited only 12 sites, the results are indicative.

Category	Day	Night
Satisfactory	1	2
Marginal	0	0
Serious	4	5
Critical	7	5

Essentially, there was not a lot of difference between day and night. Four sites were more hazardous at night and 2 sites were less hazardous. The same overall pattern exists, namely, a predominance of sites in the "Serious" and "Critical" Categories, although the reason for the high rating changed form day to night.

Transit Audits

Transit Auckland Regional Office has commissioned some audits using our Interim Procedures. They have kindly agreed to the inclusion of their results in this paper. The audits were of HCH (High Capacity Highway) sites. The following table gives the results for 5 sites on motorways and 13 sites on highways.

Category	Motorway	Highway
Satisfactory	0	0
Marginal	1	2
Serious	1	5
Critical	3	6

Yet, again, the same pattern is emerging. The auditors assessed half the sites to be in the "Critical" category. At this point it is worth repeating a feature of the SHR. Recall that the SHR is made up of 3 factors:

- Site Condition Factor
- Site Complexity Factor
- Traffic Effects Factor

All the HCH are by definition high volume and are likely to be high-speed roads too. The Site Complexity Factor will be on the high side. If the site includes reducing the number of lanes, then the Traffic Effects Factor will be high too. This means that a site can score quite "well" on the "Site Condition Factor" and still be classified as Critical. This reflects the risk.

Significant Findings

Transfund commissioned a report summarising the findings of the 1998 pilot audits. We have published the report as RA98/669S "1998 Pilot Safety Audits of Traffic Control at Roadwork Sites: Summary Report". In this section I will mention only some of the findings. Readers are referred to this report for further details.

The issues noted include:

- Temporary speed restrictions
- Approach layouts
- Side Roads
- Inadequate delineation
- Personnel safety

We found no speed restrictions that were enforceable in law. There were defects in the signs, lack of temporary plates, the sign spacing and the reinstatement of the speed limit. It is little wonder that the Police find the enforcement of temporary speed limits difficult.

Many deficiencies were seen with approach layouts; for example: parked vehicles obstructing signs, signs omitted, unnecessary signs and the poor condition of signs.

Over half the side roads audited had no signs at all.

Many sites did not have any delineation. Where delineation was provided, often the spacings of devices were inadequate. Approach tapers were either non-existent or too short. The use of 44-Gallon Drums was still much in evidence.

In terms of personnel safety we saw both plant and personnel working in live lanes; we saw excavations not properly protected; we observed inadequate provision of alternative pedestrian routes. Many workers were not wearing high visibility clothing.

Issues

I have presented a new safety audit methodology. Transfund has issued the methodology as interim procedures.

The majority of sites inspected in our pilot audits were classified as "Serious" or "Critical". The problem appears to be nation-wide, and not specific to any road type or type of work. Our audits look only at the end product. They can offer no explanation as to why the sites showed significant hazards. The feedback we received from the seminars mentioned above has indicated a number of issues worth exploring.

Inconsistent documentation

The first component under this heading is the issue of standards and guidelines. There are inconsistencies between the current documents and this hinders good practice. These inconsistencies are recognised and are one of the reasons behind Transit's working group's revision of the current manuals into one document.

The second component is inconsistent contract documents. Contractors say that these inconsistencies hinder the provision of good practice, as Contractors do not know what the client expects. Can good practice be achieved through appropriate contractual arrangements? Would a level playing field be achieved if RCAs provided clear guidelines in with the contract documents with respect to their Traffic Control expectations?

Even if contracts do specify the traffic control required, some say that the Consultants do not supervise contracts as well as they should and that Contractors know that they can get away with substandard work and not get penalised. Is it an issue of the professional service contract not making a sufficient allowance for on-site supervision, or is this an issue where Contractors need to recognise their responsibilities in respect of site safety? In terms of HSE Act it is their responsibility.

Competitive environment

Some say that the competitive environment hinders good practice. They say that Contractors, who do comply with good practice, are being disadvantaged by those who don't and get away with it.

Do the Competitive Pricing Procedures (CPP) impede good practice? We were given examples of the use of CPP that gave scant regard to traffic control, where price was almost the sole determining factor. However others thought that the proper use of the CPP procedures could provide sufficient emphasis to traffic control. Lump sum payments and provisional sum were offered as the way around the competitive nature of CPP, but this did not get universal support.

Training

If the feedback at the seminars is to be believed, many Contractors, clients and Consultants have had either no training in traffic control or their training is out of date. Contracts can specify that certain training is required, but are these conditions ever invoked?

Transfund considers that training is an industry responsibility. Transfund's role should be one of supporting and encouraging training. Training programmes exist, but there is little evidence that what is presented during the training courses actually appears on the road.

Incentives and Sanctions

Do the present accountability mechanisms facilitate or hinder good traffic control? It would appear that whatever incentives exist, they are not working. Two possible sanctions were mentioned at the seminars: non-payment of the traffic control component of the contract schedule and closure of the site.

The Principal to a contract has the authority to refuse payment to the Contractor for poor traffic control. The Principal to the contract also has the authority to close a roadwork site. We were told that both these sanctions are used, they are both available at present.

It appears to us that either these practices are not widespread or they are ineffective.

Agencies' roles

Contractors are clearly concerned that motorists do not drive through roadworks "properly" and that they need to be "educated". However, our audits have shown that the provision of good traffic control is a rare event. It is difficult to see how the motorist can be persuaded to behave differently when they have learnt that roadwork signs can be ignored. in many cases.

Enforcement is seen as the best "persuasion" tool. However our audits did not find one temporary speed limit that was enforceable in law. Therefore it is difficult to see how the Police would be interested in enforcing temporary speed limits at roadwork sites until such time as the industry has demonstrated that it can install and maintain complying speed limit signage

OSH administers the HSE Act. OSH looks to the industry for the appropriate standards. In our case, at present, they are "Working on the Road" or Transit's GI or HCH Manual. Should a crash occur at a roadwork site, then it is possible that OSH could take action against the Contractor and the Principal for not complying with the HSE requirement. At present the industry as a whole is taking a risk by not complying with current industry standards and are laying themselves open to litigation.

What is Transfund's role in all of this? Is it limited to raising awareness, providing an audit procedure and supporting industry training? Transfund's principal objective is to "*allocate resources to achieve a safe and efficient land transport system"*. Transfund has to ensure that the funds it allocates contribute effectively to safety in all phases of a roading project including the physical construction phase.

Moving Forward

Our audit results tell us that traffic control at roadwork sites must be improved. In this paper I have described a new safety audit methodology and given the results of our pilot audits. We have issued the methodology as Interim procedures and we welcome feedback on the procedures.

We have looked overseas for similar procedures, but to date, we believe that this is the only attempt to undertake audits of this type.

Perhaps the audit procedure will encourage RCAs to take a firmer stand. In this way risks will be reduced – resulting in a reduction in the numbers and severity of crashes at roadworks sites. The possibility of litigation and site closure will also be reduced.

Reference

Transfund New Zealand Review and Audit Division Report RA98/689S "Interim Procedures for the Safety Audit of Traffic Control at Roadwork Sites" February 1999.

Transfund New Zealand Review and Audit Division Report RA98/699S "1998 Pilot Safety Audit of Traffic Control at RoadWork Sites: Summary Report" February 1999.

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